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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/566,099

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Tadahiro Ohmi

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FOLEY AND LARDNER LLP

SUITE 500

3000 K STREET NW

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EXAMINER

BIRBACH, NAOMI L

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

11/24/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/566,099

Applicant(s)

OHMI ET AL.

Examiner

NAOMI BIRBACH

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 July 2009.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-16 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 20 July 2009 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/22)
4) ☐ Interview Summary (PTO-413)
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____
Paper No(s)/Mail Date _____

DETAILED ACTION

Response to Amendment

1. Claims 1-16 are pending. Applicant's amendments in the response filed 7/20/09 are acknowledged.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
5. Claims 1-3 and 14 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over USPA 2002/0005213 to Otsuki.
6. It is noted that claim 1 is a product by process claim. Otsuki discloses a silicon carbide product comprising a polycrystalline silicon carbide that is cleaned only by an

acidic solution and has a surface with a concentration of metal impurities equal or less than 1×10^{11} (atoms/cm³) (Page 1, Paragraphs [0012]-[0013]; Page 7, Paragraph [0075]; Page 8, Paragraph [0093]). In the alternative, because of the nature of product-by process claims, the Examiner cannot ordinarily focus on the precise difference between the claimed product and the disclosed product. It is then Applicants' burden to prove that an unobvious difference exists. See In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983). Product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps (MPEP 2113 [R-1]).

7. As to claim 2, Otsuki further discloses that said metal impurities may be Iron, Nickel or Copper (Page 11, Table 1).

8. As to claim 3, Otsuki further discloses that the silicon carbide product is a semiconductor device (Page 1, Paragraph [0002]).

9. It is noted that claim 14 is a product by process claim. Otsuki discloses a polycrystalline silicon carbide product that is cleaned only by an acidic solution and has a surface concentration of metal impurities equal or less than 1×10^{11} atoms/cm³ (Page 1, Paragraph [0013]; Page 7, Paragraphs [0075] [0081]; Page 8, Paragraph [0084]). Otsuki discloses that the silicon carbide product is a semiconductor device (Page 1, Paragraph [0002]). In the alternative, because of the nature of product-by process claims, the Examiner cannot ordinarily focus on the precise difference between the claimed product and the disclosed product. It is then Applicants' burden to prove that an unobvious difference exists. See In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983).

Product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps (MPEP 2113 [R-1]).

10. Claims 4-12 are rejected under 35 U.S.C. 102(b) as being anticipated by USPA 2002/0005213 to Otsuki et al.

11. As to claim 4, Otsuki discloses a silicon carbide product cleaning method comprising the step of immersing a silicon carbide in an acid, wherein the step of immersing the silicon carbide in the acidic solution reduces surface metal impurities to 1×10^{11} atoms/cm³ or less (Page 7, Paragraph [0081]; Page 8, Paragraphs [0084], [0093]-[0095]). Otsuki teaches that the silicon carbide is polycrystalline (Page 7, Paragraph [0075]).

12. As to claim 5, Otsuki discloses a method of manufacturing a silicon carbide product composed of a polycrystalline silicon carbide, comprising: forming a polycrystalline silicon carbide (Page 7, Paragraph [0075]) and cleaning silicon carbide only with an acidic solution to reduce surface metal impurities to 1×10^{11} atoms/cm³ or less (Page 1, Paragraph [0013]; Page 8, Paragraphs [0084], [0093]-[0095]).

13. As to claim 6, Otsuki further discloses that the acid is hydrochloric or hydrofluoric acid (Page 8, Paragraph [0094]).

14. As to claim 7, Otsuki further discloses that said acid is hydrofluoric acid (Page 8, Paragraph [0094]). Otsuki teaches that the concentration of the organic acid is preferably 0.3 to 68% by weight (Page 8, Paragraph [0095]), which exceeds 45%.

15. As to claim 8, Otsuki further discloses that the hydrofluoric acid (Page 8, Paragraph [0094]) preferably has a concentration of 0.3 to 68% by weight (Page 8, Paragraph [0095]), which includes a concentration of about 50%.
16. As to claim 9, Otsuki further discloses that said acid is hydrochloric acid (Page 8, Paragraph [0094]). Otsuki teaches that the concentration of the organic acid is preferably 0.3 to 68% by weight (Page 8, Paragraph [0095]), which exceeds 35%.
17. As to claim 10, Otsuki further discloses that the hydrochloric acid (Page 8, Paragraph [0094]) preferably has a concentration of 0.3 to 68% by weight (Page 8, Paragraph [0095]), which includes a concentration of about 36%.
18. As to claim 11, Otsuki further discloses that the acid may comprise a mixture of sulfuric acid and hydrogen peroxide (Page 8, Paragraph [0094]).
19. As to claim 12, Otsuki does not expressly disclose that the liquid containing said sulfuric acid and said hydrogen peroxide solution has a pH of 4 or less (Page 8, Paragraph [0094]). However, pH is a result effective parameter, because it affects the acidity of the cleaning solution, thus affecting the processing. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the method taught by Otsuki in order to enhance cleaning efficiency, consult In re Boesch and Slaney 205 USPQ 215 (CCPA 1980).

Claim Rejections - 35 USC § 103

20. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

21. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over USPA 2002/0005213 to Otsuki et al. as applied to claim 12 above, and further in view of USPN 6,348,157 to Ohmi et al.
22. Otsuki is relied upon as discussed above with respect to the rejection of Claim 12.
23. As to claim 13, Otsuki discloses using sulfuric acid with a concentration of 98% in the cleaning liquid (Page 10, Paragraph [0134]), but does not expressly disclose that the hydrogen peroxide solution has a concentration of about 30% or that the sulfuric acid and hydrogen peroxide are mixed in a volume ratio of 4:1.
24. Ohmi discloses a cleaning solution comprising 97% sulfuric acid and 30% hydrogen peroxide mixed in a volumetric ratio of 4:1 (Col. 8, lines 47-51). Ohmi teaches that this solution is used to clean a silicon substrate (Col. 8, lines 47-51).
25. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Otsuki to include a 97% sulfuric acid and 30% hydrogen peroxide mixed in a volumetric ratio of 4:1 as taught by Ohmi in order to optimize cleaning, as a solution with these properties has been demonstrated to be effective in removing contaminants from a silicon substrate.
31. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over USPA 2002/0005213 to Otsuki et al as applied to claim 11 above, and further in view of USPA 2004/0029392 to Morgan.

32. Otsuki is relied upon as discussed above with respect to the rejection of Claim 11.

33. As to claim 12, Otsuki does not expressly disclose that the solution containing sulfuric acid and hydrogen peroxide has a pH of 4 or less.

34. Morgan discloses a known cleaning solution of sulfuric acid and hydrogen peroxide which typically has a pH of no greater than 1, which is less than 4 (Page 1, Paragraph [0008]). Morgan teaches that this solution is used to remove metallic contaminants from a substrate surface (Page 1, Paragraphs [0007]-[0008]).

35. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Otsuki to include a sulfuric acid and hydrogen peroxide solution with a pH of 4 or less as taught by Morgan to optimize cleaning, as a solution with this pH has been demonstrated to be effective in removing contaminants.

36. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over USPA 2002/0005213 to Otsuki et al. in view of USPA 2004/0029392 to Morgan as applied to claim 12 above, and further in view of USPN 6,348,157 to Ohmi et al.

37. Otsuki and Morgan are relied upon as discussed above with respect to the rejection of Claim 12.

38. As to claim 13, the combination of Otsuki and Morgan does not expressly disclose that the sulfuric acid and hydrogen peroxide solution respectively have concentrations of about 97% and about 30% and are mixed in a volume ratio of 4:1.

39. Ohmi discloses a cleaning solution comprising 97% sulfuric acid and 30% hydrogen peroxide mixed in a volumetric ratio of 4:1 (Col. 8, lines 47-51). Ohmi teaches that this solution is used to clean a silicon substrate (Col. 8, lines 47-51).

40. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Otsuki and Morgan to include a 97% sulfuric acid and 30% hydrogen peroxide mixed in a volumetric ratio of 4:1 as taught by Ohmi in order to optimize cleaning, as this solution has been demonstrated to be effective in removing contaminants from a silicon substrate.

41. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over USPA 2002/0005213 to Otsuki et al. as applied to claim 5 above, and further in view of "Applications of High Purity SiC Prepared by Chemical Vapor Deposition" to Chinone et al.

42. Otsuki is relied upon as discussed above with respect to the rejection of claim 5.

43. As to claims 15 and 16, Otsuki further discloses that the polycrystalline silicon carbide is formed over a graphite base member (Page 6, Paragraph [0068]; Page 7, Paragraph [0075]). Otsuki does not expressly disclose that the silicon carbide layer is grown by a CVD method over a base member where the silicon carbide layer is separated by burning out the graphite base member.

44. Chinone discloses that it is known to grow silicon carbide layers on graphite bases by a CVD method, followed by separating the silicon carbide layer from the

graphite base member by burning out the graphite base member to form the silicon carbide product (Page 198).

45. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Otsuki to include growing the crystalline silicon carbide over a graphite base by a CVD method as taught by Chinone for the benefit of producing a silicon carbide product with low impurity levels, near theoretical density and good adherence (Page 198, Introduction).

Response to Arguments

46. Applicant's arguments filed 7/20/09 have been fully considered but they are not persuasive.

47. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., physical and chemical characteristics of single-crystalline or polycrystalline silicon carbide such as density, porosity) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Otsuki teaches that the sintered silicon carbide is polycrystalline (Page 7, Paragraph [0075]), thus it reads on the claim limitations.

48. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention

where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the properties of the solutions taught by Morgan and Ohmi would reasonably be expected to remove metallic contaminants from silicon carbide since Otsuki teaches using a solution of sulfuric acid and hydrogen peroxide to clean silicon carbide of metal contaminants (Page 8, Paragraphs [0093]-[0094]). Furthermore, it was not suggested to apply the cleaning process taught by Otsuki et al. to silicon.

49. Applicant argues that a plurality of cleaning steps must be performed in Otsuki's method in order to obtain a silicon carbide with a surface cleanliness of less than 1×10^{11} (atoms/cm³). However, the claims recite the transitional term "comprising", which is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. See MPEP 2113.03 [R-3]. Even if other cleaning steps are performed, it is only because of the acidic solution that the metal impurities are reduced to less than 1×10^{11} atoms/cm³ (Page 8, Paragraph [0093]-[0095]).

Conclusion

50. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

51. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

52. Any inquiry concerning this communication or earlier communications from the examiner should be directed to NAOMI BIRBACH whose telephone number is (571)270-7367. The examiner can normally be reached on Monday-Friday, 8:00am-5:30pm.

53. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

54. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic

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Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/N. B./

Examiner, Art Unit 1792

/Michael Kornakov/

Supervisory Patent Examiner, Art Unit 1792